

WIND ENERGY TECHNOLOGIES OFFICE

Public Stakeholder Meeting to Receive input on DOE's Draft Wind Energy Environmental Research Strategy *June 24, 2016 - Meeting Summary*

Purpose and Objectives

The Department of Energy's (DOE) Office of Energy Efficiency and Renewable Energy (EERE) works to accelerate development and deployment of energy efficiency and renewable energy technologies and market-based solutions that strengthen U.S. energy security, environmental quality, and economic vitality. The Wind Program invests in projects that seek to understand and mitigate the impacts of wind energy on wildlife and to address other siting issues to further the sustainable deployment of wind energy technologies.

On June 24, 2016, the Wind Program held a public meeting at the National Renewable Energy Laboratory (NREL) (noticed in Vol. 81, No. 105 of the Federal Register on June 1, 2016) to seek input on its draft 5 to 15 year wind energy environmental research strategy. Specifically, the purpose of this meeting was to solicit individual input on near-term and long-term wind energy environmental research priorities. The Program also sought input on how the draft plan aligns with and complements the current and future research goals and plans of other individuals and relevant stakeholder organizations. During the meeting, the program presented highlights from the draft strategy document (still under development), which are attached in Appendix 2, below.

Meeting Overview

Greeting and Introductions

Jocelyn Brown-Saracino, Manager for the Wind Energy Technologies Office's (WETO) environmental research portfolio, initiated the meeting with a presentation and discussion of the purpose and objectives for the session. She reviewed the meeting agenda, highlighted the structure of discussions, and emphasized the importance of stakeholder input in drafting an environmental research strategy for the Wind Program. Participants discussed that for the

purposes of this meeting the term “mitigation” refers to the mitigation hierarchy: impact avoidance, impact minimization, and compensatory mitigation for unavoidable impacts.

Strategy Overview

Ms. Brown-Saracino continued her presentation with an historical overview of the Wind Program’s support for environmental research, including activities with the National Laboratories, as well as wind industry, academic, and other award recipient organizations. Additionally Ms. Brown-Saracino provided a brief overview of the Wind Program’s 2015 *Wind Vision* report, and how the *Wind Vision*’s roadmap actions for developing strategies to mitigate environmental impacts are tied into the meeting discussion and the development of the Wind Program’s environmental research strategy. She also reviewed a habitat range map of species of concern overlaid with a map of developable wind resources in the US to illustrate the extent of overlap between developable wind resources and species of concern.

The presentation then turned to a very high level overview of the Wind Program’s draft environmental strategy, broken down by topics (Eagles, Bats, Prairie Grouse, and Offshore Wind Impact Characterization and Analysis), activities associated with each topic, the anticipated impact of the activities, and the expected long-term outcomes. Research priority highlights, by topic, included:

Bats:

- To improve understanding of the factors that drive risk to bats at wind turbines, including research to better understand the underlying relationship between bats and wind turbines (e.g. attraction, timing, and meteorological conditions which drive activity levels, etc.)
- To develop and validate potential impact mitigation measures, including refinements to operational impact minimization strategies and development of deterrent systems,, and
- To develop and validate potential compensatory mitigation measures as needed in the future

Eagles:

- To improve accuracy and reduce uncertainty around estimates of take at wind farms,
- To develop and validate potential take avoidance and minimization measures, and
- To develop and validate potential compensatory mitigation measures

Prairie Grouse:

- To evaluate the potential impact of wind turbines on prairie grouse species, and
- To develop and validate compensatory mitigation options, as needed

Offshore Wind:

- To collect environmental impact data and support testing of monitoring and mitigation technologies at first-generation projects, and
- To synthesize environmental impact data and develop predictive models

Information Synthesis and Dissemination:

- Tethys database, to house information on environmental research and make it easily accessible
- Collaborative efforts such as Working Together to Resolve Environmental Effects of Wind Energy (WREN) initiative, the National Wind Coordinating Collaborative (NWCC), the Bats and Wind Energy Cooperative (BWEC) and associated activities, including webinar series, conferences, and analyses that present the current state of knowledge regarding wind-wildlife monitoring techniques, impacts, and mitigation strategies.

Following this overview, Ms. Brown-Saracino posed the following questions to the attendees to consider with respect to the Program's general strategic approach, noting that there would be time for discussion of research priorities for specific species later on:

1. Does the WETO strategy address what you see as the key research priorities? If not, what's missing? What priorities do you see as most urgent?
2. To your mind, does the strategy capture what you see as the desired outcome for the sector?
3. How well does this draft plan align with the research and data collection plans of your organization and other entities?

Below is a summary of participant's comments and discussion of the Wind Program's general strategy approach, as well as comments on each of the specific research areas listed above.

Summary Comments on the Wind Program's general approach

- At a high level, participants concluded that the specific species and related research activities proposed by the Wind Program largely address the research priorities critical to wind energy stakeholders
- With respect to how best to approach existing and emerging research questions, numerous participants discussed the importance of coordination of research priorities and strategy across federal agencies and other groups. This discussion included a specific reference to the development, expansion, and maintenance of a database of raw, standardized, anonymous wind-wildlife impact data that can be used to support new research, in addition to databases such as Tethys, which houses completed research.
- Participants mentioned the need for a better understanding of risks to wildlife from all sources (natural and anthropogenic), particularly other forms of power generation, in order to better characterize and contextualize the relative impact of wind energy on a given species or issue. There is also a need to evaluate wind energy's positive attributes (relative air pollutant and carbon emissions, water use and pollution, fuel use and storage, etc. compared with traditional energy generation sources) weighted against its impacts to develop a robust comparative cost-benefit analysis of wind power.
- Further, on the topic of risk and quantitative certainty, participants discussed the issue of how regulators currently and have historically approached risk (precautionary principle). Participants noted the need for regulators to formalize how and what level of risk uncertainty they can), and the need for a mechanism to incorporate peer-reviewed

research, which helps reduce uncertainty around risk, into the policy and practice of permitting wind developments.

- While the proposed topics covered the most pressing issues, some participants noted that the strategy should consider impacts to other species that might emerge as species of concern in the future, as well as the need for metrics or criteria for determining if and when an emerging issue should be given attention, given limited private and public funding for addressing existing issues

Summary comments and discussion regarding the Wind Program's research priorities for bats

- While the specific activities related to bat research align with stakeholder needs, the outlined strategy does not specifically address refining take estimators for rare species and rare events. The absence of better tools in this area results in financial and logistical challenges for developers in terms of calculating accurate risk levels
- Some suggested that in consideration of the dearth of information on bat populations, locations, and migratory movements, there is a need to collect these data before trying to evaluate how to "grow" or create bats to compensate for unavoidable take
- However, others contended that as more bat species become listed under the Endangered Species Act, resulting from anthropogenic and natural sources (such as White Nose Syndrome and climate change), compensatory mitigation requirements may become a higher priority for research investment as there are no compensatory mitigation tools currently available for bats.

Summary comments and discussion regarding the Wind Program's research priorities for eagles

- There is still work that can be done to improve models that estimate risk, including updating current golden eagle Bayesian model with data reflective of the risks posed by current generation wind energy technology, rather than data from first generation facilities in California, which do not accurately reflect the risk profile of modern wind turbines and may overestimate the risks posed by modern turbines
- There is a need to develop a Bayesian take estimator model, or developing specific assumptions or priors for bald eagles, as the current FWS model uses only golden eagle data. Additionally, models should include variables such as topography and behavior
- Some revised priors have already been developed, but the timeline or likelihood of adoption or integration of these updated models by regulators is not yet determined
- Newer models may also require validation with field data
- While research efforts are underway to develop impact minimization technologies there is still a lack of baseline (unmitigated operational) data to accurately validate the effectiveness of proposed mitigation solutions
- Development and validation of industry and regulator accepted mitigation tools will remain a high priority until one or more viable and affordable options becomes commercially available

Summary comments and discussion regarding the Wind Program's research priorities for prairie grouse

- Historically, funding research on the impact of wind energy on prairie grouse species has proven difficult due to regulatory concerns over the potential listing of species under ESA, state-level species regulations, and the subsequent lack of development projects in relevant habitat areas and resulting lack of investment interest
- Conducting multiple Before-After-Control-Impact (BACI) studies are highly important for accurately characterizing baseline risk and response, but can take up to 10 years at one site to demonstrate statistically powerful results. Some participants suggested that the Wind Program should consider focusing on post-construction analysis studies to evaluate grouse behavior against a non-developed control site (gradient analysis)
- Some suggested that the outlined strategy and research should focus on lesser prairie chicken habitat in the near term, as there is almost no industry-specific information regarding wind power impacts to the species; species-management decisions are being made based on studies related to other sources of human impact
- Compensatory mitigation research for prairie grouse species is not a near term research priority, but conservation banks do offer some current compensatory mitigation options

Summary comments and discussion regarding the Wind Program's research priorities for offshore wind environmental issues

- Due to the relative lack of data in this area, short term research plans should continue to focus on the collection of baseline data of sea birds and marine mammals, saving data meta-analysis for a mid-term priority focus area
- Due to the nascent status of the offshore wind industry in the US, there is a need for near-term focus on concerted stakeholder engagement and outreach to educate the public and other stakeholders about offshore wind
- In the offshore space, the complex and dynamic nature of the environment poses challenges for quantifying risk at specific sites
- Other issues to consider include scour (currents digging out base of turbines), and noise from pile driving (but, that will not likely be a problem in areas other than along the Atlantic coast of the US (Pacific Ocean, etc.), due to the limits deeper waters place on the ability to drive piles for turbine platforms, and the future availability of floating platforms that are anchored to the seabed in lieu of driving piles

Summary comments and discussion regarding the Wind Program's research priorities for emerging environmental issues

- It is important to have multiple mitigation options for a given species due to various factors that can influence the effectiveness or applicability of the measure at different sites. For example, the use of operational adjustments to minimize impacts to bats in the southeast may not be feasible due to turbine operational economics even though it may be a solution in other geographic locations
- While DOE and the wind industry should pay attention to emerging issues, limited funding resources available for research should be focused on addressing existing, unresolved issues

- Participants discussed other potential wildlife issues that may emerge in the near future including gray bats, nectar-feeding bats in the southwest, western yellow, southern yellow, Seminole bats, pollinators, and ungulates
- Other impact mitigation ideas included investigating enhancing resources for wildlife outside of wind facilities (such as creating attractive roost locations, or prey management) to lure species of concern away from high risk areas around wind turbines
- To better understand where climate impacts may affect wind energy, participants discussed the idea of developing climate models that include wind energy resources and changing habitats to see how and where species may move, and how wind resources may change over time (and drive development in new areas)
- Participants revisited the idea of developing a set of criteria to evaluate when, or if, a new environmental issue warrants concerted attention

Appendix 1 – Written Comments Received Outside of the Meeting


- BWEA has long worked to move away from the term “curtailment”, when describing changing turbine operations to minimize impacts to bats, given the somewhat negative connotation and fact that it means different things to different parties. Suggest the use of operational adjustments and/or informed curtailment measures when referring to wildlife “curtailment”
- Mention could be made of the importance of collaboration on databases
- The strategy should recognize the need for funding, as well as provide a research timeline linked to the long term goals set forth in the 2015 Wind Vision Research Roadmap, as well as the near term deployment plans for wind driven by the PTC (production tax credit) and the CPP (clean power plan)
- It’s important to understand when the results of this proposed research will be needed/completed to address impacts likely to occur in the near and mid-term
- The strategy should include an estimate of the 5 & 10 year budget needs, as well as some provide deference to the concept of making investments in projects that are both biologically effective, but also economically viable, compared with the current cost, if a baseline exists, of the topic of the R&D effort
- The program should consider a 3 year research plan, as opposed to a 36-year research plan
- The strategy could benefit from metrics to help decide which programs should be accelerated with additional funding (e.g. those that have the greatest impact on MW deployment, or show greatest promise to mitigate impacts to species of concern)
- The need to develop, refine, and validate tools to evaluate the potential risk to wildlife at a given undeveloped site has been a key research issue since 1994. The research strategy should continue to focus on this issue as these tools are not yet adequate for industry needs, with respect to bats, in particular. Avoiding high risk locations and high risk turbine layouts would be much better than curtailment or deterrents. The high level strategy and the summary comments on eagles hint at this type of effort, but it should be a clearly called out
- The strategy should include some exploratory work on developing an eagle deterrent method. It is hinted at in the write-up, but not stated
- It is important to note that monitoring has been conducted for the past 30 years but most of it is useless for broadly understanding effects of wind turbines on wildlife due to the varying methodologies utilized in the collection of the data. The strategy should give priority to designing robust monitoring standards that can become accepted best practices by stakeholders and regulators. Results of studies conducted with these methods could then be provided to a database for additional meta-analysis
- With respect to eagles, it is important to note that many of the noted “non-DOE actions” are underway at FWS, but proceeding slowly. A small bit of funding from DOE could expedite these research efforts dramatically
- The term “Market Barriers” may be misleading in terms of the work that will be conducted under this program

- The table on slide 7 of the highlights presentation could be clearer. The current format suggests that Eagles, Bats, and Grouse are only an issue for land based wind
- The long-term outcomes of this strategy should also consider or note excluding or shrinking areas for development based on how impacts to species are addressed over time
- While listed species of concern (bats, eagles, grouse) are important, the final strategy should also address the status of impacts to other birds such as geese, song birds, etc. and why they are not high priority
- How will solutions for the species of concern ultimately benefit other species?
- Strategy should reinforce and stress the idea that research done in collaboration with the Department of Energy should be overseen and peer reviewed by independent experts to ensure credibility of results.
- If possible, future versions of the research strategy should include target dates for adoption of taller towers (e.g. 140m towers) to help contextualize when new issues may start emerging, and by when those issues should be investigated
- Are pollinators a real concern when considering future impacts of wind on wildlife?

Appendix 2 – Draft Wind-Environmental Strategy Highlights – Presentation Slides

Wind Power Program **DRAFT** Environmental Research Strategy: 2016-2030

U.S. DEPARTMENT OF **ENERGY** | Energy Efficiency & Renewable Energy



June 24, 2016 - Draft deliberative document. For discussion purposes only. Not intended for citation.

Wind and Water Power Technologies Office
Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy

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Welcome

U.S. DEPARTMENT OF **ENERGY** | Energy Efficiency & Renewable Energy

The Wind and Water Power Technologies Office (WWPTO), within the U.S. Department of Energy's (DOE's) Office of Energy Efficiency and Renewable Energy (EERE), supports the development, deployment, and commercialization of wind and water power technologies.

The Wind Program invests in projects that seek to understand and mitigate the impacts of wind energy on wildlife and to address other siting issues to further the sustainable deployment of wind energy technologies.

- Purpose:
 - Seek input on wind energy near-term and long-term environmental research priorities needed to help enable the sustainable development of wind energy technologies in the United States
- Goals:
 1. Share the Wind Program's proposed environmental research strategy
 2. Seek individual input on whether the WWPTO strategy addresses key wind energy stakeholder research priorities
 3. Seek individual feedback on how the proposed draft strategy meshes with the research plans of other entities

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Agenda

8:30 am	Welcome Review of DOE goals for meeting <i>Review agenda</i>
8:45 am	Participant Introductions
9:00 am	DOE environmental research history and future draft strategy
9:30 am	High level discussion of strategy priorities
9:50 am	Research strategy for addressing risk to bats
10:20 am	<i>Break</i>
10:40 am	Research strategy for addressing risk to eagles
11:10 am	Research strategy for addressing risk to prairie grouse species
11:30 am	Offshore wind environment research priorities
12:10 am	Emerging issues for land-based and offshore wind
12:30 pm	<i>Lunch/Final thoughts and next steps</i>
1:30 pm	Optional NWTC facility tour
2:30 pm	<i>Adjourn</i>

Please Note

It is not the object of this session to obtain any group position or consensus relating to any of the ideas or research priorities discussed. Participants should limit information and comments to those based on personal experience, individual advice, information, or facts regarding this topic. This meeting is an opportunity for participants to gain an individual understanding of the Wind Program's Draft Environmental Research Strategy. To most effectively use the limited time please refrain from passing judgment on another participant's recommendations or advice and, instead, concentrate on your individual experiences.

History and Evolution of DOE Support for Environmental Research

U.S. DEPARTMENT OF
ENERGY | Energy Efficiency & Renewable Energy

1994 – Formation of the National Wind Coordinating Collaborative (NWCC)

- Bi-Annual State of the Science Research Meetings
- Methods and Metrics document

2003 – Bats and Wind Energy Cooperative

- Curtailment, at least 50% fatality reduction

2006 to 2013 – (NWCC) Grassland Community Collaborative

- 7 year Prairie Chicken Study found no strong effect.

2009 – 20% by 2030 FOA funds a suite of environmental research

- Todd Katzner publishes work on eagle telemetry and spatial risk
- Funded development of BWEC initial bat deterrent device

2011 to Present – (NWCC) Sage Grouse Collaborative

2011 – National Offshore Wind Strategy and Market Barriers FOA Announced. National Lab work on Offshore Environmental issues began at this time as well

2015 – Bat Impact Mitigation Technologies FOA



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History and Evolution of DOE Support for Environmental Research

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FOA Announcement: Eagle Impact Minimization Technology Development and Field Testing Opportunities

- Funding Opportunity Announcement is soliciting applications that propose projects supporting impact minimization technologies in three Topic Areas.
- Topic Area 1 will intend to support research on eagle ability to sense and respond to stimuli, in an effort to identify signals that will serve as optimal deterrents.
- Topic Area 2 will intend to further the technical readiness of Technology Readiness Level (TRL) 5-6 detect and deter and informed curtailment systems through technical improvement and testing activities.
- Topic Area 3 will intend to support the demonstration of a proposed TRL 7+ detection and/or minimization technology at an operational wind facility at a scale sufficient to provide an accurate demonstration of efficacy through a statistically significant reduction of impact at a reasonable cost.

Full solicitation at: <https://eere-exchange.energy.gov>

Informational Webinar: Monday, June 27 from 11–12:30 pm EDT.
<https://attendee.gotowebinar.com/register/7532006869286916097>

All questions should be directed to:
EagleImpact@ee.doe.gov

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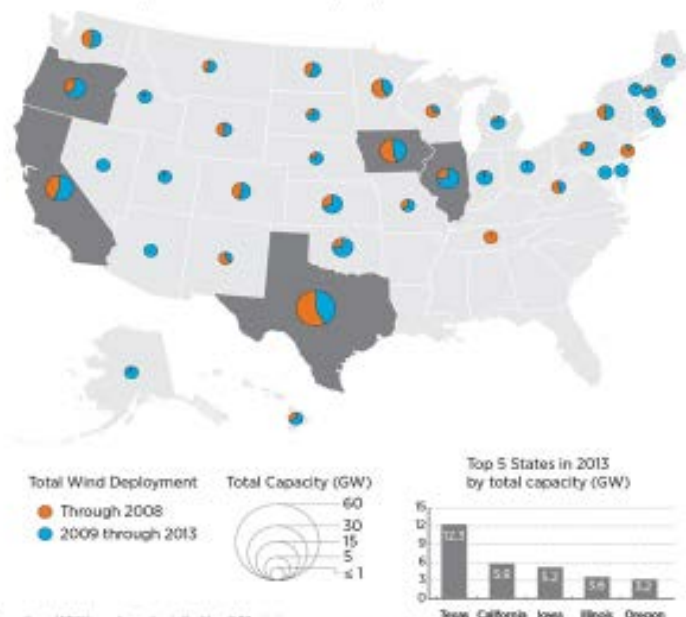
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The Wind Vision Report Wind Capacity by State - 2013

U.S. DEPARTMENT OF
ENERGY | Energy Efficiency & Renewable Energy

In 2013, cumulative utility-scale wind deployment reached 61 GW across 39 states



Distributed wind projects with less than 1 MW have been installed in all 50 states

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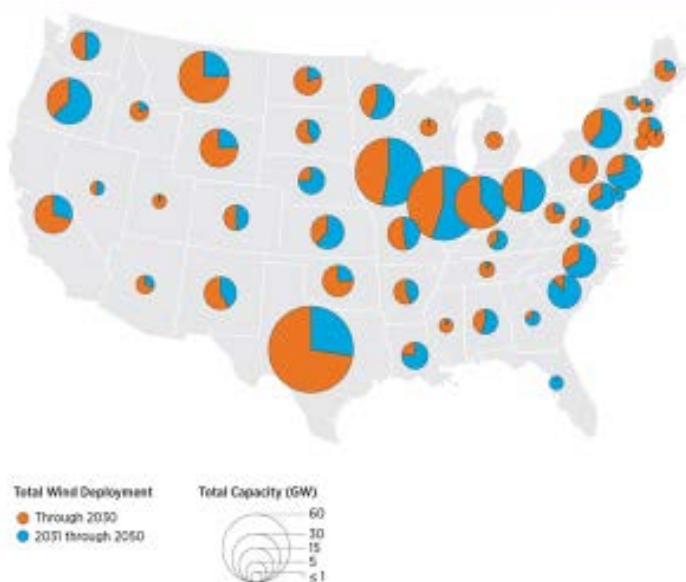
The Wind Vision Report Wind Capacity by State – 2050

U.S. DEPARTMENT OF
ENERGY | Energy Efficiency & Renewable Energy

Wind Energy in 2050

Installed capacity is concentrated in certain regions, but overall **wind deployment is geographically widespread (50 states by 2050)**; U.S. southeast deploys new wind with higher towers, advanced performance and offshore

32 states have over 1,000 MW of wind capacity (land-based + offshore) by 2030; 40 states by 2050 (compared with 16 today)



Note: Results presented are for the Central Study Scenario. Across Study Scenario sensitivities, deployment by state may vary depending on changes in wind technology, regional fossil fuel prices, and other factors. ReEDS model decisionmaking reflects a national optimization perspective. Actual distribution of wind capacity will be affected by local, regional, and other factors not fully represented here. Alaska and Hawaii cannot be currently modeled in ReEDS but will contribute to overall wind deployment.

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The Wind Vision Report The Study Scenario

U.S. DEPARTMENT OF
ENERGY | Energy Efficiency & Renewable Energy

The Potential of 35% of the Country's Electricity Coming from Wind Energy by 2050

Costs	Benefits		
			
\$149 Billion [3%] savings	GHG: 14% less GHG; \$400 Billion savings	\$108 Billion savings; 22,000 lives saved	260 Billion gallons [23%] less consumption

Additional Impacts

				
Energy Diversity	Jobs	Local Revenues	Land Use	Public Acceptance and Wildlife
Electricity prices 20% less sensitive	- 600,000 gross jobs	\$1.0 Billion/year in land leases \$3.2 Billion/year in tax payments	15% area of contiguous US Less than 1/3 area occupied by golf courses in US today	Responsible siting; Optimizing coexistence

The Wind Vision Study Scenario results in modest increases in electricity cost in the near- and mid-term (<1% price increase), but in the long term electricity costs savings of 2% are achieved by 2050

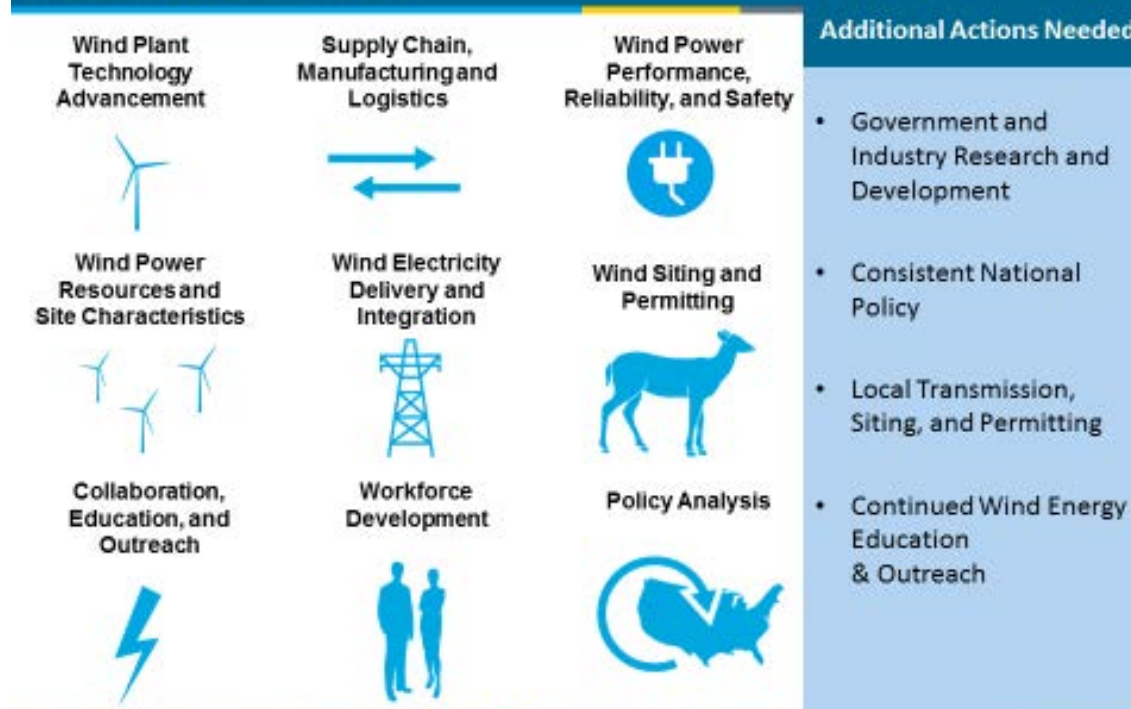
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The Wind Vision Report Roadmap of Targeted Actions

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Wind Vision Roadmap: Actions for Mitigating and Minimizing Environmental Impacts

U.S. DEPARTMENT OF
ENERGY | Energy Efficiency & Renewable Energy

ACTION 6.2: Develop Strategies to Mitigate and Minimize Siting and Environmental Impacts

Develop and disseminate relevant information as well as minimization and mitigation strategies to reduce the environmental impacts of wind plants, including impacts on wildlife.

DELIVERABLE: Accurate information and peer-reviewed studies on actual environmental impacts of wind power deployment, including on wildlife and wildlife habitat.

IMPACT: Decreased environmental impact by all wind technologies; improved understanding of the relative impact of wind development; defined methodologies to assess potential impacts and risks; and shorter and less expensive project deployment timelines.

KEY THEMES: Reduce Wind Costs; Expand Developable Areas

MARKETS ADDRESSED: Land, Offshore, Distributed

ACTION	DELIVERABLE	IMPACT	BEGIN	END
ACTION 6.2.1: Improve understanding of wildlife and habitat impacts. Develop and disseminate relevant information on wildlife and habitat impacts, including cumulative impacts in relation to other activities within the ecosystem.	Information and peer-reviewed studies on the actual wildlife and habitat impacts of wind power deployment in relation to other energy production, which can be used and shared through a variety of platforms.	Improved understanding of the relative impact of wind development; shorter and less expensive project deployment timelines.	2014	2050
ACTION 6.2.2: Develop strategies to reduce wildlife impacts. Develop, test and conduct research on strategies to mitigate, avoid, minimize, or compensate for impacts to wildlife.	Proven technologies and strategies that will reduce wind power impacts on wildlife.	Decreased wildlife impact by all wind technologies; shorter and less expensive project deployment timelines.	2014	2050

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Wind Vision Roadmap: Actions for Mitigating and Minimizing Environmental Impacts

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ENERGY | Energy Efficiency & Renewable Energy

ACTION	DELIVERABLE	IMPACT	BEGIN	END
ACTION 6.2.3: Develop a funding pool for wildlife research. Implement a shared funding pool from industry, government, and other interested parties to fund wildlife research administered by an independent third party with appropriate oversight.	Fact-based research, mitigation practices, and independent analysis on key wildlife impacts.	Expansion of industry- and government-based research that is credible and independent of undue influence from interested parties.	2014	2050
ACTION 6.2.4: Perform strategic assessment of offshore wind. Conduct strategic environmental assessments to inform siting and add to the knowledge base for future permitting of offshore wind projects.	Assessments that provide baseline environmental data for offshore wind needed by federal and state governments to inform siting, permitting, and marine spatial planning efforts.	Increased knowledge of which marine resources may be at risk in certain locations; reduced permitting timelines and risk for projects.	2014	2030
ACTION 6.2.5: Continue monitoring environmental impacts. Continual monitoring of environmental and wildlife impacts to assess changes and their potential impacts.	Periodic updates of known environmental impacts, targeting market and impact assessments.	Improved understanding of known impacts, as well as their evolution over time due to changes in technology, markets and affected species.	2014	2050

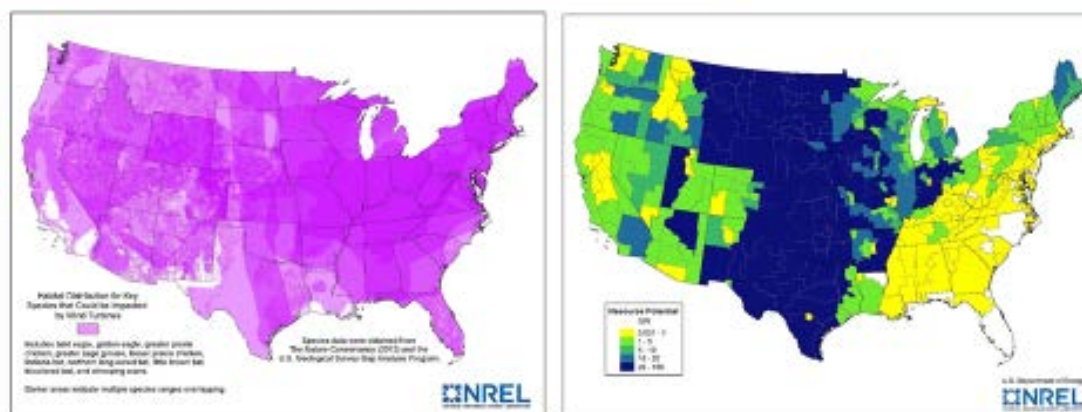
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Wildlife Habitat & Wind Resource Potential Maps

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Environmental and Wildlife Initiatives Designed to Mitigate Market Barriers

U.S. DEPARTMENT OF
ENERGY | Energy Efficiency & Renewable Energy

Topic	Land-Based Wind			Offshore Wind
	Eagles	Bats	Prairie Grouse	Offshore Wind Impact Characterization and Analysis
Focus of Activities	<ul style="list-style-type: none"> Develop tools and models for estimating take and informing siting Develop and validate impact mitigation measures Evaluate quantifiable compensatory mitigation measures, as needed 		<ul style="list-style-type: none"> Conduct long-term Before-After Control-Impact (BACI) studies across multiple wind sites to assess potential impact of wind power on grouse populations Develop and refine siting tools Develop compensatory mitigation tools, as needed, to offset potential risks 	<ul style="list-style-type: none"> Research to evaluate environmental impact <ul style="list-style-type: none"> Data collection to better understand impacts and inform regulatory decision making Development and testing of monitoring and impact minimization tools <ul style="list-style-type: none"> Testing of tools at 1st generation project sites Meta-analyses of impacts <ul style="list-style-type: none"> Develop predictive risk models Synthesizing data to inform effective monitoring and mitigation measures
Specific Impact	<ul style="list-style-type: none"> Better understand the relationships between wildlife and wind turbines Increase availability of risk minimization and mitigation tools to reduce impacts to wildlife 			<ul style="list-style-type: none"> Better understand environmental impacts and how to measure those impacts
Long-Term Outcomes	<ul style="list-style-type: none"> Preserve or expand geographic areas available for development Reduce siting and regulatory uncertainty for developers Ensure environmentally sustainable coexistence of wind energy and wildlife 			

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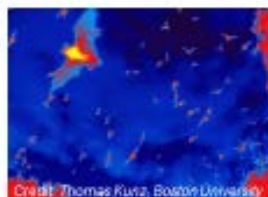
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Proposed DOE Research Priorities: Bats

U.S. DEPARTMENT OF
ENERGY | Energy Efficiency & Renewable Energy

The Wind Power Program currently envisions supporting future research:

- To improve understanding of the factors that drive risk to bats at wind turbines, including research to better understand the underlying relationship between bats and wind turbines
- To develop and assess potential minimization measures, including refinements to curtailment strategies and development of deterrent devices, and
- To develop and assess potential compensatory mitigation measures as needed in the future



Credit: Thomas Kutz, Boston University



Credit: Brock Fenton



Credit: Humboldt University



Credit: Courtesy, Marine Corps Base Quantico

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Proposed DOE Research Priorities: Eagles

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Renewable Energy

The Wind Power Program currently envisions supporting future research:

- To improve accuracy and reduce uncertainty around estimates of take at wind farms,
- To develop and assess potential take avoidance and minimization measures, and
- To develop and assess potential compensatory mitigation measures



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Proposed DOE Research Priorities: Prairie Grouse

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Renewable Energy

The Wind Power Program currently envisions supporting future research:

- To evaluate the potential impact of wind turbines on prairie grouse species, and
- To develop and validate compensatory mitigation options, as needed



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Proposed DOE Research Priorities: Offshore Wind

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Renewable Energy

To address the various environmental offshore wind concerns over the next fifteen years, DOE developed a number of approaches under the following general research themes:

- Collect environmental impact data and support testing of monitoring and mitigation technologies at first-generation projects, and
- Synthesize environmental impact data and develop predictive models



Credit: Sanford University



Credit: Brian Skerry National Geographic



Credit: EcoFys

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Proposed DOE Information Synthesis and Dissemination

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Renewable Energy

DOE aims to continue its support for information aggregation and sharing efforts, including:

- Tethys database, to house information on environmental research and make it easily accessible
- Collaborative efforts such as Working Together to Resolve Environmental Effects of Wind Energy (WREN) initiative, the National Wind Coordinating Collaborative, the Bats and Wind Energy Cooperative and associated activities, including webinar series, conferences, and analyses that present the current state of knowledge regarding wind-wildlife monitoring techniques, impacts, and mitigation strategies.

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High Level Discussion of Strategic Priorities

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- Does the WWPTO strategy address what you see as the key research priorities? If not, what's missing? What priorities do you see as most urgent?
- To your mind, does the strategy capture what you see as the desired outcome for the sector?
- How well does this draft plan align with the research and data collection plans of your organization and other entities?

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Detailed Strategy by Focus Area

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- Bats
- Eagles
- Prairie Grouse
- Offshore Wind
- Future Impacts/Concerns

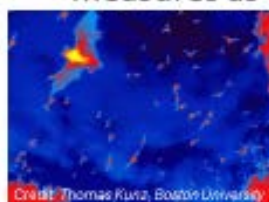
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The Wind Power Program currently envisions supporting future research:

- To improve understanding of the factors that drive risk to bats at wind turbines, including research to better understand the underlying relationship between bats and wind turbines
- To develop and assess potential minimization measures, including refinements to curtailment strategies and development of deterrent devices, and
- To develop and assess potential compensatory mitigation measures as needed in the future



Credit: Thomas Kutz, Boston University



Credit: Brock Fenton



Credit: Humboldt University



Credit: Courtesy, Marine Corps Base Quantico

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Proposed Non-DOE Action

Factor	Research Priorities	Wind Vision Action
1) Understand Population and Habitat Use	a) Assess population status, trends, and genetic diversity	ACTION 6.2.1: Improve understanding of wildlife and habitat impacts
2) Understand Sources of Mortality	a) Conduct research to identify sources of mortality, assess effects of anthropogenic non-energy, and energy related activities, assess impact of environmental disease/contaminant factors, characterize importance of mortality agents b) Develop and operate a database of bat fatalities; hypothesize predictor variables	ACTION 6.2.1: Improve understanding of wildlife and habitat impacts

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Research Priorities: Bats

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ENERGY

Energy Efficiency &
Renewable Energy

Proposed DOE Research Partnership Focuses

Factor	Research Priorities	Wind Vision Action
1) Improve Take Estimates and Risk Models	a) Design studies to document behavior around wind turbines to better understand the relationship between behavior/activity and risk, as well as elucidate patterns in peak mortality events b) Systematic testing of hypotheses regarding the factors that drive risk through lab and field observation and experimentation for multiple species across a range of geographies c) Support meta-analyses to further explore the relationship between pre-construction bat activity levels and post-construction mortality rates d) Work to develop and refine models used for predicting risk at wind farms	ACTION 6.2.1: Improve understanding of wildlife and habitat impacts
2) Develop Impact Minimization Tools	a) Refine existing operational reduction measures to maximize mortality reduction while minimizing revenue loss. Evaluate environmental factors such as temperature, barometric pressure, and precipitation on bat activity into risk models. Assess economic impact to wind farms in emerging regions with lower class wind speeds, where cut-in speed adjustments will have a greater financial impact. b) Continue to support the development of deterrent technologies to minimize risks at operational wind farms. Ensure applicability to taller turbines, as turbine size increases over time.	ACTION 6.2.2: Develop strategies to reduce wildlife impacts
3) Evaluate Compensatory Mitigation Tools	a) Evaluate, quantify and test additional options for compensatory mitigation, as needed in the future	ACTION 6.2.2: Develop strategies to reduce wildlife impacts

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Discussion Questions: Bats

U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy

- Do proposed research areas focus on the highest priority issues for bats?
- Understanding interaction between bats and turbines
 - Given the work that's currently ongoing in this space, need for additional DOE work in this area? If so, to your mind what are the largest gaps?
- Improve operational adjustment regimes
 - Given current efforts underway to develop and refine operational adjustment regimes, should "smart curtailment" be an essential/top priority research area for the DOE?
- Compensatory mitigation
 - Is there a need for the validation of strategies here? Relative priority?

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The Wind Power Program currently envisions supporting future research:

- To improve accuracy and reduce uncertainty around estimates of take at wind farms,
- To develop and assess potential take avoidance and minimization measures, and
- To develop and assess potential compensatory mitigation measures



Credit Politico



Golden Eagle © Klaus007 Stock/Pixmaps

Proposed Non-DOE Actions

Factor	Research Priorities	Wind Vision Action
1) Understand Population and Habitat Use	<ul style="list-style-type: none"> a) Spatial/temporal avian habitat use and habitat variation studies to characterize how eagles use their environment, and important habitat conditions re: hunting, migration, nesting, wintering, etc. b) Develop robust monitoring protocols for eagle nest surveys, and conduct annual surveys of breeding pairs to assess nest success, and fledgling survival. Study natal dispersal of golden and bald eagles c) Assess population trends, and genetic diversity/variability utilizing DNA to understand relationships between eagle populations d) Assess climate change impacts to Bald and Golden eagle habitat - including vegetation and prey base – and consequent population effects 	ACTION 6.2.1: Improve understanding of wildlife and habitat impacts
2) Understand Anthropogenic Sources of Mortality	<ul style="list-style-type: none"> a) Conduct research to identify sources of mortality, assess effects of anthropogenic non-energy, and energy related activities, assess impact of environmental disease/contaminant factors, characterize importance of mortality agents b) Develop and operate a database of eagle fatalities; hypothesize predictor variables 	ACTION 6.2.1: Improve understanding of wildlife and habitat impacts

Research Priorities: Eagles

Proposed DOE Research Partnership Focuses

Factor	Research Priorities	Wind Vision Action
1) Improve Take Estimates and Risk Models	a) Design studies to document behavior around wind turbines; b) Conduct several replicated Pre- and Post-construction studies across a broad geographic range, and conduct meta-analysis utilizing eagle habitat, wind site use information, and post-construction fatality data to identify risk patterns with explanatory variables c) Work to develop and refine models used for predicting risk at wind farms. Continuously refine estimates of eagle fatalities and risk at wind energy facilities as new data become available for integration	ACTION 6.2.1: Improve understanding of wildlife and habitat impacts
2) Develop Impact Minimization Tools	a) Develop, test, and evaluate curtailment and avoidance measures, such as informed curtailment and/or deterrent technologies to minimize risks at operational wind farms	ACTION 6.2.2: Develop strategies to reduce wildlife impacts
3) Evaluate Compensatory Mitigation Tools	a) Evaluate, quantify and test additional options for compensatory mitigation such as lead abatement and carcass removal	ACTION 6.2.2: Develop strategies to reduce wildlife impacts

Discussion Questions: Eagles

- Do proposed research areas focus on the highest priority issues for Eagles?
- Eagle risk modeling
 - In the 2016 Proposed Eagle Rule, the FWS notes that they will require all permit applicants to use the FWS take prediction model
 - Given this and the alternate model development work that's been done to date, is there a need in the space for additional model development? Analysis of data to refine model parameters?
- Mitigation technology testing and validation
 - After the completion of testing efforts planned or underway, what do you anticipate the longer term needs in this space will be?
- Compensatory mitigation
 - Still necessary considering FWS' proposal for mitigation/conservation banking?

Research Priorities: Prairie Grouse

U.S. DEPARTMENT OF
ENERGY | Energy Efficiency & Renewable Energy

The Wind Power Program currently envisions supporting future research:

- To evaluate the potential impact of wind turbines on prairie grouse species, and
- To develop and validate compensatory mitigation options, as needed



Credit: BLM



Credit: Joanna Stashow / USFWS



Credit: U.S. Fish and Wildlife Service

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Research Priorities: Prairie Grouse

U.S. DEPARTMENT OF
ENERGY | Energy Efficiency & Renewable Energy

Proposed Non-DOE Actions

Factor	Research Priorities	Wind Vision Action
1) Understand Population and Habitat Use	a) Assess population status, trends, and genetic diversity	ACTION 6.2.1: Improve understanding of wildlife and habitat impacts
2) Understand Anthropogenic Sources of Mortality	a) Conduct research to identify sources of mortality, assess effects of anthropogenic non-energy, and energy related activities	ACTION 6.2.1: Improve understanding of wildlife and habitat impacts

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Research Priorities: Prairie Grouse

Proposed DOE Research Partnership Focuses

Factor	Research Priorities	Wind Vision Action
1) Research Potential Impacts	<p>a) Conduct BACI studies evaluate the effect of wind energy development on grouse species, including evaluation of variables such as adult survival, lek success, and fecundity</p> <p>b) Analyze habitat suitability variables across broad sage grouse habitat regions to develop and refine risk factor models associated with landscape patterns, and inform most appropriate turbine siting locations based on areas of least likely impact to grouse</p>	ACTION 6.2.1: Improve understanding of wildlife and habitat impacts
2) Evaluate Compensatory Mitigation Tools	a) Evaluate, quantify and test/implement additional options for compensatory mitigation, as needed in the future. (Note this work will leverage the work done to date for other impacts to grouse.)	ACTION 6.2.2: Develop strategies to reduce wildlife impacts

Discussion Questions: Prairie Grouse

- Do proposed research areas focus on the highest priority issues for prairie grouse?
- Critical species of focus?
- If effect established, current compensatory mitigation options sufficient?

To address the various environmental offshore wind concerns over the next fifteen years, DOE developed a number of approaches under the following general research themes:

- Collect environmental impact data and support testing of monitoring and mitigation technologies at first-generation projects, and
- Synthesize environmental impact data and develop predictive models



Credit: Stanford University



Credit: Brian Skerry, National Geographic



Credit: EcoFys

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Non-DOE Actions Needed

Factor	Research Priorities	Wind Vision Action
1) Understand Population and Habitat Use	a) Continue baseline data collection b) Update and analyze marine wildlife and habitat baseline data to better inform regional planning and development decisions	ACTION 6.2.4: Perform strategic assessment of offshore wind

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Research Priorities: Offshore Wind

Proposed DOE Focus

Factor	Research Priorities	Wind Vision Action
1) Develop Impact Minimization Tools	a) Support testing of monitoring and mitigation technologies at first-generation projects b) Collect environmental impact data to better understand of the relative impact of offshore wind development, increase regulatory certainty of impacts, and minimize environmental compliance costs	ACTION 6.2.2: Develop strategies to reduce wildlife impacts
2) Improve Take Estimates and Risk Models	a) Synthesize environmental impact data to improve basis for implementation of effective and prudent monitoring and mitigation measures b) Develop predictive models of impacts from offshore wind energy installations on sensitive species to decrease in environmental impacts	ACTION 6.2.1: Improve understanding of wildlife and habitat impacts

Proposed Issues of Focus

- **Noise**
 - Monitoring noise produced by construction activities
 - Developing and testing novel tools for monitoring marine mammals around construction activities
 - Testing and validating mitigation measures as needed
- **Collision**
 - Developing and testing tools for validating avian collision risk
 - Conducting research to validate collision risk models
 - Testing and validating application of land-based impact minimization tools to offshore wind turbines, as needed
- **Habitat Use**
 - In the longer term, monitoring changes in habitat use by key species in and around offshore wind farms

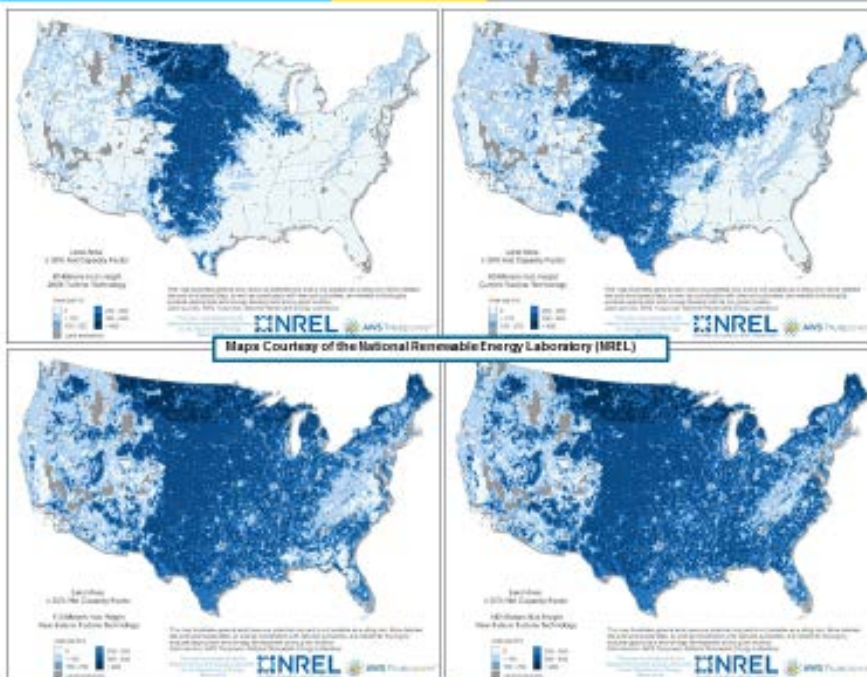
Discussion Questions: Offshore Wind

- Do proposed research areas actions on the highest priority issues for offshore wind?
- To your mind, are the issues of focus the issues of highest priority?

Potential Emerging Future Issues

Representation of land area with a net capacity factor of greater than or equal to 30% at various wind hub heights and technology levels

Top Left: 80-meter hub height, 2008 turbine technology
Top Right: 80-meter hub height, current turbine technology
Bottom Left: 110-meter hub height, near-future turbine technology
Bottom Right: 140-meter hub height, near-future turbine technology



Potential Emerging Future Issues

Considering the future of wind development in the US, we anticipate:

1. *Development of wind power in new regions of the US resulting from the near-future adoption and deployment of advanced turbine technologies*
2. *New species of concern for wind development and operation due to continued population stress from other anthropogenic and natural factors such as climate change or White Nose Syndrome, as well as expanded wind development*

Actions for consideration:

- Explore/understand potential environmental impacts of development in regions that will be made accessible through the use of taller towers and larger turbines and the new challenges that are posed by those new technologies
 - For example, expansion of land-based wind in the SE:
 - Cut-in speed adjustments will have a greater effect on revenue since building in lower wind class sites
 - Larger rotor swept areas increase challenges for ultrasonic acoustics
 - Potential for need for more focus on bald eagles
- Shift regional focus as offshore wind technology changes. As the commercial readiness of floating wind technologies advances, greater emphasis will be placed on regions such as the Pacific

Discussion Questions: Emerging Issues

- As we look to the future, are there issues that you anticipate will increase in priority as the wind industry expands and grows?
- Are there species that weren't discussed today, that you think are high priority?
- To what degree should emerging issues be prioritized, as compared to identified expending resources on addressing current high priority species of concern?